

REMARKS

Claims 1-6, 15-28, 45 and 49-51 are pending in this application. Claims 2, 3, 7-9 and 29-33 have been canceled in this amendment, without prejudice to pursuing the subject matter of these claims in a further application. Claim 1 has been amended to recite that the substrate is contacted with one or more CDO precursors having a carbon-carbon triple bond in a dual frequency plasma enhanced deposition process such that the deposited film has a compressive stress or a tensile stress of magnitude less than about 30 MPa and a dielectric constant of not greater than about 3. Claim 45 has been amended to recite that the substrate is contacted with one or more CDO precursors having a triple bond in a dual frequency plasma enhanced deposition process such that the deposited CDO film has a cracking threshold of at least 3.0 μm . Support for these amendments may be found throughout the specification, including in original claims 2, 3 and 39 and paragraphs 39, 81 and 97. No new matter has been added.

Claim Rejections Under 35 USC §§ 102 and 103

All claims have been rejected under 35 USC § 102(b) or 35 USC § 103(a) as anticipated by or obvious over Rhee, et al., WO 03/005429 (“Rhee”).

Rhee describes depositing SiCO:H films using unsaturated precursors in the presence of O₂ using a single high frequency power source. (See Figure 1A and the accompanying description on page 4, which describes only a single high frequency source 10.) In Example 8, Rhee describes using ETMS to deposit a film.

Applicants’ claims recite use of a dual frequency power source to deposit films having low residual stress (magnitude of less than 30 MPa) and a dielectric constant of less than 3.0. The use of both the dual frequency power source and the specific carbon-carbon triple bond precursors recited in the claims are critical in obtaining films having these characteristics.

Applicants found that using a dual RF source is critical to obtaining films having a residual stress of magnitude less than 30 MPa and dielectric constant of less than 3.0. Applicants refer to the Declaration of Dr. Wu, and specifically to Appendix A, which shows Figure 10 from the application. As explained in Dr. Wu’s declaration, this figure shows that LF power is critical

in obtaining low stress films and that deposition of a TMSA (also called ETMS) film with a comparable dielectric constant using the single source of Rhee would result in a stress of at least 40 MPa – well above Applicants' claimed range. Applicants have thus shown that using a dual frequency source is critical to the deposition of low stress films containing carbon-carbon triple bonds. Applicants have also shown that the single source frequency described in Rhee would result in a high residual stress.

Also as explained in the Declaration and shown in the data presented in Appendix B, precursors having Si-CH₃ groups and a -C≡C- group provide the lowest tensile stress in the low-k range, and are the only precursors to result in less than 0 MPa (compressive) stress. All of the precursors recited in claim 1 have an Si-CH₃ group and a -C≡C- group.

At least because Applicants have shown that both the claimed precursors and the use of a dual frequency source are critical in obtaining the claimed stress and dielectric constants, Applicants submit that claim 1 and its dependent claims are patentable over Rhee.

Applicants also submit that claim 45, which recites a cracking threshold of at least 3 μm is patentable – as explained in Dr. Wu's declaration with reference to Appendix C, deposition of an ETMS (TMSA) film using a single frequency power source resulted in a cracking threshold below 2 μm, while using a dual frequency power source resulted in a cracking threshold above 3 μm. Thus, Applicants have shown that using a dual frequency source is critical to the deposition

For at least these reasons, Applicants respectfully request withdrawal of the rejections.

Conclusion

Applicants believe that all pending claims are allowable and respectfully request a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at the telephone number set out below. If it is determined that any additional fees are due, the Commissioner is hereby authorized to charge such fees to Deposit Account 500388 (Order No. NOVLP094).

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Respectfully submitted,
BEYER WEAVER, LLP

/ Denise Bergin/_____
Denise Bergin
Reg. No. 50,581

Tel.: 510-663-1100
P.O. Box 70250
Oakland, CA 94612-0250